

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 2, 30 and 32 are currently being amended. Support for this amendment can be found at least in FIG. 15 and the corresponding text in the specification. Claims 2-36 remain pending.

Examiner Interview

Applicant appreciates the personal Examiner Interview with Examiner Edwards on July 24, 2007, the Interview Summary of which is of record in the application. Applicant's representative, Thomas Bilodeau, and Examiner Edwards discussed the recitation in independent claim 2 "to start the main combustion after the preliminary combustion is finished," and similar features in independent claims 30 and 32. Applicant's representative argued that neither Salvat nor Tashiro suggests this feature in the context of those claims, as further discussed below. Moreover, the claims have been amended to clarify that the preliminary fuel injection is the injection immediately prior to the main fuel injection.

Rejections under 35 U.S.C. §§ 102 and 103

Claims 2-4, 7, 8, 10-13, 17, 18, 27-30 and 35 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,412,276 to Salvat et al. (hereafter "Salvat"). Claims 30, 32-34 and 36 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,901,747 to Tashiro et al. (hereafter "Tashiro"). Claims 5, 6, 19 and 31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 4,685,290 to Kamiya et al. (hereafter "Kamiya"). Claims 9, 14-16, 20, 21 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 6,804,952 to Sasaki et al. (hereafter "Sasaki"). Claims 22-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 6,796,118 to Kitahara (hereafter "Kitahara"). Applicant respectfully traverses these rejections for at least the following reasons.

Independent claims 2, 30 and 32 have been amended to clarify that the preliminary fuel injection is the fuel injection immediately prior to the main fuel injection. Independent claim 2 recites that “the controller is configured . . . to perform a main fuel injection to start the main combustion after the preliminary combustion is finished, . . . the preliminary fuel injection being immediately prior to the main fuel injection.” Independent claims 30 and 32 recite similar features of respectively “controlling fuel injection to start main combustion after an end of the preliminary combustion” and “means for . . . controlling fuel injection to start main combustion after an end of the preliminary combustion,” where the preliminary fuel injection is the fuel injection immediately prior to the main fuel injection. Thus, in claims 2, 30 and 32, the fuel injection is controlled to start the main combustion after the preliminary combustion is finished, where the preliminary fuel injection is the fuel injection immediately prior to the main fuel injection. Salvat and Tashiro fail to disclose or suggest at least this feature of independent claims 2, 30 or 32 in the context of those claims, or realize the advantages attendant to such a feature.

In contrast to claims 2, 30 and 32, where the fuel injection is controlled to start the main combustion after the preliminary combustion is finished, both Salvat and Tashiro disclose control systems where a plurality of injections are performed so as to achieve continuous combustion. Thus, in the Salvat and Tashiro systems, fuel in a subsequent injection is injected into the flame of the fuel previously injected.

With respect to the combustion of Salvat and Tashiro, the Office Action, on page 13, states:

Applicant has argued that the Salvat and Tashiro systems fail to teach starting a main combustion after a preliminary combustion. The examiner respectfully disagrees. In each of Salvat and Tashiro there are multiple pre injections that cause combustions. Looking at Figure 3 of Salvat, I'1 represents pre-combustion which concludes when combustion I'2 starts. If the flame of I'1 had not yet extinguished at the start of I'2, then all of that flame then merges with an becomes I'2. The main combustion, I'3, follows I'2. By this interpretation, combustion I'1 has finished at the start of combustion I'3, and therefor Salvat reads on the claimed invention. A similar interpretation of Tashiro is also argued with respect to Figures 1-B and 1-C of Tashiro.

Applicant submits, however, that Salvat merely discloses in FIG. 3, that the fuel injection I'3, starts after the fuel injection I'2 (the fuel injection immediately prior to the injection I'3) has finished. The fuel injection I'1 is not immediately prior to the fuel injection I'3, and thus is not pertinent to the preliminary fuel injection as claimed. Salvat does not disclose that the combustion associated with the fuel injection I'2 finishes before the fuel injection I'3 for the main combustion starts. Applicants submit that one skilled in the art would understand fuel injection and combustion to be distinct processes, where the combustion may extend beyond the fuel injection. Similarly, with respect to Tashiro, Tashiro merely discloses in FIG. 1(b) and FIG. 1(c), that the pilot fuel injection Fp ends before the main fuel injection Fm begins, not that the combustion associated with the fuel injection Fp finishes before the fuel injection Fm for main combustion starts.

Moreover, Tashiro specifically suggests controlling the fuel injection so that there is a continuous combustion from the pilot injection to the fuel injection for the main combustion. The fuel injection control system in Tashiro is designed to perform a sub injection before a main injection and to sustain the combustion flame of the sub injection until the injection timing of the main injection (column 8, lines 36-44). Thus, Tashiro discloses continuous combustion from the pilot injection combustion to the main injection combustion.

Moreover, Tashiro and Salvat fail to realize the advantages resulting from the fuel injection control of independent claims 2, 30 or 32. With the fuel injection control of claims 2, 30 or 32, the incylinder temperature may be increased by preliminary combustion, and then the main combustion performed after the preliminary combustion such that is possible to increase exhaust gas temperature and realize a rich exhaust gas air fuel ratio without deteriorating the level of smoke, while achieving a desired rich atmosphere in the cylinder. Moreover, by increasing the percentage of the premixed combustion in the main combustion by starting the main combustion after the end of the preliminary combustion, the ignition delay range with the preliminary combustion can be expanded improving the target temperature controllability, and effectively reducing smoke. These advantages are not realized by the control systems of Tashiro and Salvat, which fail to disclose performing a main fuel injection to start the main combustion after the preliminary combustion is finished such that a premixed combustion process is predominant in the main combustion.

The remaining references of Kamiya, Sasaki, and Kitahara were cited for other features of the claims, but fail to cure the deficiencies of Salvat and Tahshiro.

The dependent claims are patentable for at least the same reasons as their respective independent claims, as well as for further patentable features recited therein.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date

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By

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